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November 2, 2018

Cary Slobin, Esq.  
Bowman and Brooke LLP  
5830 Granite Parkway  
Suite 1000  
Plano, Texas 75024

Re: Didier v. FCA

Dear Mr. Slobin,

Following your request, Engineering Principles®, LLC has performed certain investigations regarding the motor vehicle collision involving a minor referred to as H.G.H. The purpose of this letter is to report the results of my investigations to date. In general, I anticipate offering testimony in the areas of mechanical engineering and the design, operation, usage, and performance of occupant protection systems including seats and seat belts. Engineering Principles, LLC bills \$550 per hour for my consulting services.

## **QUALIFICATIONS AND METHODOLOGY**

My expertise is in the discipline of mechanical engineering, including the fields of occupant crash protection, accident reconstruction, mechanics, materials, and design. I have extensive experience evaluating the performance of occupant protection systems including, but not limited to, seat belts, airbags, seats, child restraint systems, and the crashworthiness of motor vehicles. I have conducted over one hundred full-scale vehicle crash tests and sled tests and reviewed thousands of additional crash and sled tests. I have evaluated and tested over one thousand seat belts and have investigated hundreds of motor vehicle collisions. My research addresses occupant protection, occupant kinematics, accident reconstruction, mechanics, material selection, and the deformation, fatigue and fracture of materials.

I have a Ph.D. in Mechanical Engineering from the Massachusetts Institute of Technology, a M.S. in Mechanical Engineering from the University of Illinois at Urbana-Champaign, and a B.S. in Mechanical Engineering from the University of Arizona. As a graduate student, I have taught mechanics and materials at the University of Illinois at Urbana-Champaign. I am a NHTSA certified Child Passenger Safety Technician. I have successfully completed a Traffic Accident Reconstruction Training course at Northwestern University.

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The generally accepted methodology for evaluating the design, safety and performance of occupant restraint systems includes analysis of factors and background such as dynamic testing, government standards, peer products, industry practices, field performance and technical work published in the literature, particularly as of the time a product is designed. In addition, the benefits and drawbacks of designs in real world applications should be considered. For this matter, I have evaluated the forensic evidence, available test data, literature, carefully considered all reasonable hypotheses, and considered plaintiff expert theories, to reach my opinions and conclusions. Appendix A includes a list of materials that I have reviewed as part of my investigation. This is the same methodology used by myself for previous matters and by other experts and knowledgeable persons in the field of occupant protection research.

## **SUBJECT COLLISION**

On December 31, 2017 a 2003 Chrysler Town and Country was traveling with four occupants (Sara Didier, driver, Brandi Didier in the right-front passenger seat, Elijah Shrader in the left-rear and H.G.H. in the second-row-right seat), when it struck the rear of a parked fire engine. H.G.H. sustained injuries in the crash, including a spinal cord injury.

## **PLAINTIFF'S CLAIMS**

Mr. Hannemann and Dr. Ziejewski, consultants retained by Plaintiffs, have stated that H.G.H. was using the seat belt properly and that her seat back was reclined. Mr. Hannemann opines she "would likely not have had critical injuries had the 2003 Chrysler Town and Country she was riding in been equipped with a seat that would not recline beyond 45 degrees while the vehicle is in motion." He also opined that an all-belts-to-seat (ABTS) restraint design "would provide better protection from safety belt shoulder harness that is not in contact with the occupant's upper torso that results from a seat that is reclined an excessive amount."

Mr. Hannemann opines that the design of the seat is defective. He opines "[t]here are numerous alternative designs that already exist and are used in present day vehicles that have direct application to the risks and dangers in the subject 2003 Chrysler Town and Country," as an alternative design. Mr. Hannemann also discusses seat back interlock concepts.

Dr. Ziejewski opines that the subject accident had a delta-V of less than 20 mph.

## **VEHICLE INSPECTIONS AND PHYSICAL EVIDENCE**

On September 4, 2018, I inspected the subject 2003 Chrysler Town and Country in Dallas, Texas.

The driver and right-front passenger seat belts are lap/shoulder belt assemblies that are equipped with pretensioners and load limiters. These seat belts have B-pillar mounted



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adjustable D-rings, buckles that are mounted to the seats and outboard anchors that are attached to the structure of the vehicle near the bottom of the B-pillars. The driver belt system has a free sliding latch plate, while the right-front passenger belt has a cinching latch plate. There is damage to the rear of the right-front passenger seat.

The second-row-left and second-row-right passenger seating positions are bucket seats, with seat belts with lap/shoulder belt assemblies. These seat belts have cinching latch plates, C-pillar mounted adjustable D-rings, buckles that are mounted to the seats and outboard anchors that are attached near the bottom of the C-pillars. Both second-row seats were found in a reclined position, with the second-row-right seat having a seat recline angle of approximately  $33^{\circ}$  from the horizontal, or approximately  $57^{\circ}$  from vertical.

There are relatively heavy load marks on the driver, right-front passenger and second-row-left seat belt hardware and webbing. There are relatively light load marks on the second-row-right seat belt.

### **EXEMPLAR SURROGATE STUDY**

On October 5, 2018, I conducted an exemplar surrogate study with Dr. Amy Courtney. The study was performed using an exemplar Chrysler 2003 Town and Country and a female surrogate the approximate height and weight of H.G.H.

The female surrogate had a standing height of approximately 60 ½ inches, a seated height of 31¼ inches and weighed 97.8 pounds. The second-row-right seat was adjusted to the position in which I found it during my vehicle inspection. The right-front seat was positioned according to the as-found subject vehicle inspection photos.

With seat and seat belt properly adjusted, the seat belt offers good fit for an occupant of H.G.H.'s size (see Figure 1).



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*Figure 1: Appropriate restraint fit*

With the seat back adjusted to the as-found angle and the occupant looking forward, leaning back with a taut seat belt, the belt would not allow H.G.H. to interact forcefully with the right-front passenger seat back (Figure 2).



*Figure 2: Reclined seat back*

## **FEDERAL MOTOR VEHICLE SAFETY STANDARD (FMVSS) TESTING**

For over 50 years, the United States Department of Transportation (DOT) has worked to ensure that “that the public is protected against unreasonable risk of accidents occurring as a



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result of the design, construction or performance of motor vehicles and is also protected against unreasonable risk of death or injury to persons in the event accidents do occur.”<sup>1</sup> This is the responsibility of the National Highway Traffic Safety Administration (NHTSA), a division of the DOT. To this end, NHTSA developed numerous Federal Motor Vehicle Safety Standards (FMVSSs) that all U.S. sold passenger vehicles must comply with. Vehicles that comply with these FMVSS have been shown to be highly effective in reducing the likelihood of serious injuries and fatalities in reasonably foreseeable motor vehicle accidents. Any suggestion that the FMVSS are minimally effective in protecting occupants from injury or death is unfounded and misleading. The FMVSSs consist of a set of specified tests that, generally speaking, evaluate the vehicle or its components relative to design and performance requirements. FMVSS 208 consists of a suite of tests that evaluates, among other things, driver and right-front passenger belted and unbelted performance in frontal collisions. FMVSS 209 tests and evaluates all vehicle seat belt assemblies at the component level. FMVSS 210 evaluates the integrity and geometry of all seat belt anchorages in a vehicle.

The Chrysler Town and Country has been thoroughly tested to ensure compliance with the FMVSSs. The 2003 Town and Country second-row-right seat belt complies with all applicable FMVSSs. Materials produced by FCA show that the seat belts meet or exceed the requirements of FMVSS 209. The occupant restraint system, including but not limited to the vehicle’s seat belts, meets or exceeds the requirements of FMVSS 208, and the seat belt anchorages meet the requirements of FMVSS 210.

The 2003 Chrysler Town & Country (and its sister vehicles) has been tested in various regulatory and consumer metric tests (NHTSA and IIHS) and has performed well in these tests, regardless of impact angle.

The subject seat belt provides a reasonable level of protection in reasonably foreseeable collisions, complies with all applicable FMVSSs, and is not defective. It has been shown in a number of studies that seat belts that comply with FMVSSs are highly effective in reducing injuries and death in reasonably foreseeable motor vehicle accidents, including rollover crashes.<sup>2, 3, 4, 5, 6, 7, 8</sup>

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<sup>1</sup> (1966) “Preamble to FMVSS.” US Congress Public Law 89-563.

<sup>2</sup> (1984) Kahane, C. “Final Regulatory Impact Analysis, Amendment to Federal Motor Vehicle Safety Standard 208, Passenger Car Front Seat Occupant Protection.” NHTSA DOT HS 806 572.

<sup>3</sup> (1990) Partyka, S. “Comparisons of Belt Effectiveness in Preventing Chest, Head and Face Injury in Front and Rear Impacts - Report.” NHTSA Docket NHTSA-1998-4047.

<sup>4</sup> (1992) NHTSA “Evaluation of Effectiveness of Occupant Protection (Final Regulatory Impact Analysis).” NHTSA

<sup>5</sup> (1993) NHTSA. “First Report to Congress on Effectiveness of Occupant Protection Systems.” NHTSA, DOT HS 808 019.

<sup>6</sup> (1996) NHTSA “NHTSA 2nd Report to Congress on Effectiveness of Occupant Protection Systems.” NHTSA.

<sup>7</sup> (2000) Kahane, C. “Fatality Reduction By Safety Belts for Front-seat Occupants of Cars and Light Trucks.” NHTSA DOT HS 809 199.

<sup>8</sup> (2004) Kahane, C. “Lives Saved by the Federal Motor Vehicle Safety Standards and Other Vehicle Safety Technologies, 1960-2002.” NHTSA, DOT HS 809 833.





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There is a variety of FMVSSs that apply to seat and seat strength (including FMVSS 207, 208, and 210), and the subject seat meets and exceeds all of these requirements. The body of FMVSS and other testing described below shows that the subject seat and seat belt are effective in reducing the likelihood of injury or death even in severe collisions.

While deferring to Dr. Nathan Dorris on warning issues, the Town and Country owner's manual specifically warns against riding in the vehicle with the seat back reclined (Figure 3).

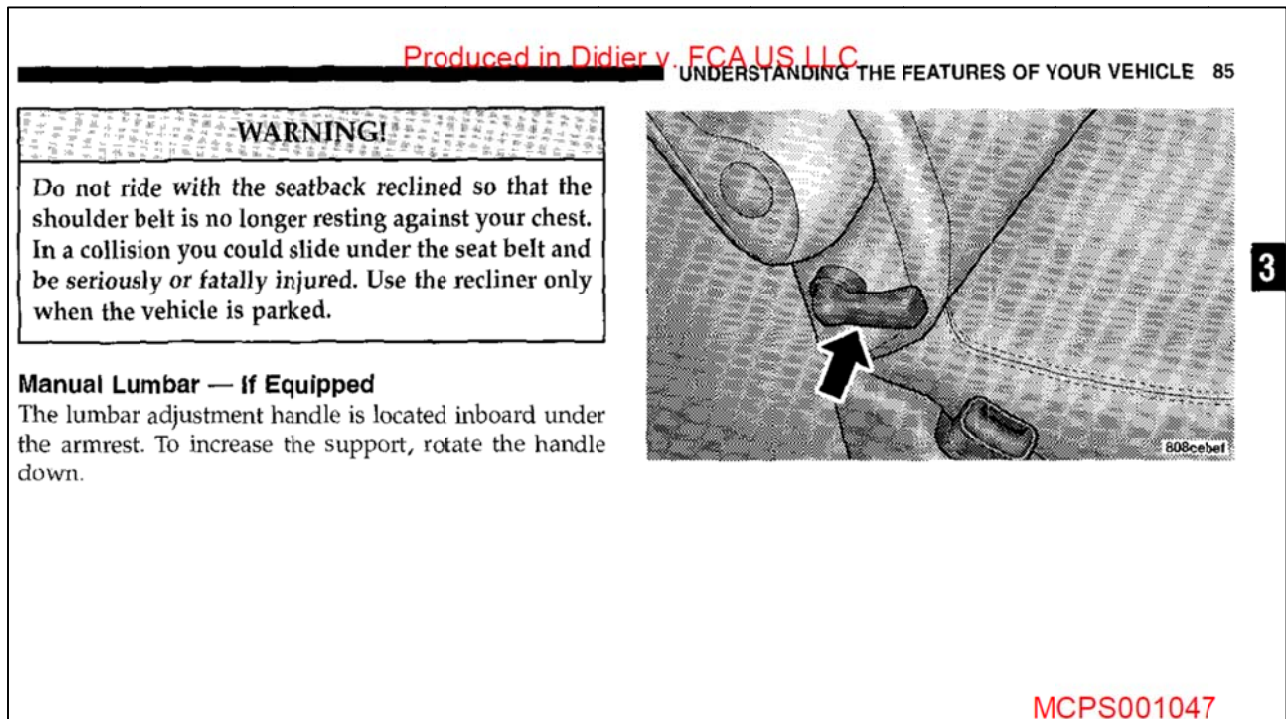


Figure 3: 2003 Town and Country owner's manual

## DISCUSSION

Per the reconstruction of Mr. Steve Fenton, the subject vehicle had a delta-V of about 27 mph with PDOF of approximately 12:15. This delta-V represents a severity greater than approximately 98% of all towable frontal collisions in the United States.<sup>9,10</sup> While Mr. Hannemann appears to criticize the use of delta-V as a measure of crash severity, delta-V is generally accepted as a measure of crash severity. While pulse duration and the shape of the acceleration pulse are also important, most collisions have a pulse duration that is relatively

<sup>9</sup> NASS CDS Severity Chart

<sup>10</sup> (2010) Goertz, A. et al. "Accident Statistical Distributions from NASS CDS." SAE 2010-01-0139.



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short and most acceleration pulse shapes have similar basic features. Therefore, delta-V is an appropriate and helpful indicator of crash severity.

With the seat back excessively reclined, as found after the subject collision, my surrogate study established that the shoulder belt would not be in contact with H.G.H.'s chest. Therefore, the shoulder belt was not able to engage the upper body early in the collision sequence and provide ride down and upper torso restraint. With the shoulder belt positioned away from the torso, this is an obvious sign that the seatbelt and seat back are not properly positioned.

With the seat back excessively reclined, as found after the subject collision and at the time of my inspection, H.G.H.'s body would be oriented such that her pelvis may have been able to move under the lap belt. In this scenario, the ability of the lap belt to engage the pelvis early in the collision sequence would have been compromised; with this reclined occupant posture, the lap belt typically will not provide ride down and restraint as effectively as if the occupant were not in a reclined posture.

### **Seat Belt Physical Evidence**

The literature contains numerous examples of how engineering analysis of seat belt marks can be used to reliably determine if and how a seat belt was worn and how the seat belt performed in a collision.<sup>11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26</sup> I have published a peer-reviewed paper looking

<sup>11</sup> (1977) Adomeit, D. et al. "Expected Belt Specific Injury Patterns Dependent on the Angle of Impact." 3rd International Conference on Impact Trauma.

<sup>12</sup> (1984) Moffatt, C. et al. "Diagnosis of Seat Belt Usage in Accidents." SAE 840396.

<sup>13</sup> (1990) Cromack, J. et al. "Occupant Kinematics & Belt Tests with Unrestrained and Partially Restrained Test Dummies." AAAM.

<sup>14</sup> (1990) Gorski, Z. et al. "Examination and Analysis of Seat Belt Loading Marks." Journal of Forensic Sciences 1990 Jan,35(1):69-79.

<sup>15</sup> (1999) Bready, J. et al. "Seat Belt Survey: Identification and Assessment of Noncollision Markings." SAE 1999-01-0441.

<sup>16</sup> (2000) Bready, J. "Characteristics of Seat Belt Restraint System Markings." SAE 2000-01-1317.

<sup>17</sup> (2006) Tanner, C. et al. "Automotive Restraint Loading Evidence for Moderate Speed Impacts and a Variety of Restraint Conditions." SAE 2006-01-0900.

<sup>18</sup> (2006) Davee, D. et al. "Case Study of Clothing Fabric Transfer to Seat Belt Webbing Under Accident Forces." SAE 2006-01-0904.

<sup>19</sup> (2006) Raymond, D. et al. "Forensic Determination of Seat Belt Usage in Automotive Collisions: Development of a Diagnostic Tool." SAE 2006-01-1128.

<sup>20</sup> (2006) Toomey, D. et al. "Safety Restraint System Physical Evidence and Biomechanical Injury Potential Due to Belt Entanglement." SAE 2006-01-1670.

<sup>21</sup> (2007) Welsh, K. et al. "Restraint System Markings and Occupant Kinematics in Crash Tests with Disabled Seat Belt Restraint Systems." ASME.

<sup>22</sup> (2008) Heydinger, G. et al. "Comparison of Collision and Noncollision Marks on Vehicle Restraint Systems." SAE 2008-01-0160.

<sup>23</sup> (2009) Jenkins, J. et al. "Forensic Analysis of Seat Belt Retractor Torsion Bars." SAE 2009-01-1242

<sup>24</sup> (2009) Brown, J. et al. "Comparison of Restraint System Marks with Proper and Improper Belt Usage." SAE 2009-01-1243.



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at this subject.<sup>27</sup> When the webbing moves over a plastic surface (like the latch plate or D-ring) with sufficient speed and force, the plastic softens and is pushed in the direction of loading and webbing movement.

The relatively light load marks on the right-rear seat belt are consistent with the ineffective restraint and lack of ride down that result with an excessively reclined seat back.

The damage to the right-front seat back is consistent with the subject child (in the second-row-right seat) being ineffectively restrained by the seat and seat belt due to the excessively reclined seat back.

This evidence on the upper portion of the right-front seat back indicates that the subject child was not only misusing the seat and seat belt by excessively reclining the seat back, but must also have been misusing the restraint system in other ways. Even with an excessively reclined seat back, a taut seat belt would likely have prevented the observed damage and marking to the upper portion of the right-front seat back. H.G.H. and/or her seat belt were likely out of position. The seat belt may have had excessive webbing extracted from the retractor and/or the shoulder belt may have been under the child's arm. H.G.H. may have turned onto her side or moved out of position in some other way. While both Mr. Hannemann and Dr. Ziejewski opine that H.G.H. was properly belted, neither offers evidence that the lap belt was correctly placed low and properly on H.G.H.'s pelvis, or that the belt was taut without extra webbing extracted from the retractor. While Dr. Ziejewski cites Brandi Didier's deposition and declaration, Ms. Didier does not mention how snug the seatbelt was or where the lap belt was placed on H.G.H.'s body.

### **Seat Design**

It is typical for vehicle manufacturers to design seat backs so that they can be reclined. Due to differences in body size and shape, different occupants often adjust the seat back to different recline angles. Just as the seat belt is adjusted differently when properly restraining different occupants, the seat back angle is also adjusted to different angles when properly restraining different occupants. Mr. Hannemann opines that there is zero benefit of having available seat recline; this is incorrect. Indeed, larger, heavier people often need to have greater seat back angle recline while maintaining their torso in an upright posture.

Mr. Hannemann proffers 45° as the limit to which the seat back recline should be held while the vehicle is in motion. He offers no data regarding why 45° is optimum or acceptable, as opposed to 40° or 50° or any other number. Specifically, he offers no data or analysis to support his assertion that if the seat recline was limited to 45°, H.G.H. would have been

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<sup>25</sup> (2009) Jakstis, M. et al. "Marks on Seat Belt Systems with Pretensioners and Force Limiters in Airbag Deployment Crashes." SAE 2009-01-1252.

<sup>26</sup> (2011) Hinger, J. "Methods for Evaluating Occupant Kinematics and Seatbelt Use During a Collision." ASME IMECE2011-64736.

<sup>27</sup> (2009) Burnett, R. et al. "Frontal Impact Rear Seatbelt Load Marks: An In-depth Analysis." SAE 2009-01-1249.





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adequately restrained or that her outcome would have been improved. While Mr. Hannemann is critical of FCA for failing to properly test the vehicle to evaluate the risks of a seatback that can recline an “excessive amount,” he has conducted no testing to support his own claims regarding safe or unsafe recline angles. Although FCA did not test with excessively reclined seats, the testing that they did do was appropriate; FCA followed regulated FMVSS tests with the recline angles specified. Testing with an overly reclined seat would defeat the purpose of the restraint system design, and hence, tests with overly reclined seats are not necessary.

Mr. Hannemann discusses some vehicles where, due to packaging, their seat back recline may be limited. Just because another vehicle limits seat recline does not make the Town and Country seats defective. Mr. Hannemann admits that there are many vehicles currently on the road that have seats “which can be reclined an excessive amount.”

He offers no specific peer vehicle (or any vehicle) make or model which has any sort of seat back interlock. He does not discuss any disadvantages to having this interlock. While saying “[t]his proposal of an interlock is not to be compared to the legislatively mandated safety belt interlocks from the 1973-1974 model years, which was a debacle”, he does not discuss why a seat back recline interlock would not be a debacle.

Mr. Hannemann refers to a patent that discusses a seat recline interlock. Just because a patent is granted does not mean a design is technologically or commercially feasible. Patents are not scientifically peer-reviewed documents; therefore claims made in patents cannot be taken as established science. Patents sometimes assert claims that are not supported by science. There are many reasons that claims are made in patents, including business and legal reasons that have nothing to do with engineering or science. Patents are typically written by lawyers rather than engineers. Additionally, the patent that Mr. Hannemann refers to seems to discuss a physical linkage between a floor-mounted gear shift and an adjacent front seat. It is not clear how this design could be a feasible with a second-row (removable) seat and with the Town and Country gear-shift that it is steering-column mounted. It is unclear if Mr. Hannemann is opining that the entire transmission design should be designed around this interlock.

With respect to the second patent, Mr. Hannemann seems to be saying that an electrical interlock could be utilized, without discussing the technology needed to measure the seat back recline (static, relative to vehicle or relative to ground). Indeed, if a user needed to make an emergency departure in his vehicle, and was prevented from doing so because a seat was at 46° or greater, this could cause not only consumer confusion and frustration, but also possibly endangerment in emergent situations.

He also does not discuss how this interlock would be achieved and still accommodate removable second row seats. Any electrical interlock would need to have connections robust enough to survive repeated seat removal and insertion efforts, with potential consumer responsibility to achieve this electrical (and/or mechanical) connection. In minivans, there are often spilled drinks and items on the floor. Having an electrical interlock based on connections in the floor that would prevent vehicle movement could be prone to failure due to the relatively dirty environment in minivans.



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Mr. Hannemann offers all-belts-to-seats (ABTS) as an alternate design for the second-row seats. With ABTS, all the seat belt anchorages are incorporated into the vehicle seat. He does not identify any peer 2003 minivan which had second-row ABTS, or any peer minivans from any year that had second-row ABTS seats.

The upper seat belt anchorages in the subject vehicle front and second-row seating positions are mounted to the vehicle's B-pillars and C-pillars. This type of mounting has been the traditional mounting location of shoulder belt anchorages since lap/shoulder belt installation became mandated for front seat occupants in 1974, and has been proven to be extremely functional and effective; the seat belt is anchored to a stiff and strong portion of the vehicle structure, and can withstand occupant loading in reasonably foreseeable motor vehicle accidents. The overwhelming majority of vehicles produced have used this traditional mounting of the shoulder belt anchorage to the pillars for minivan occupants, with excellent results in the field.

As discussed, with ABTS, all the seat belt anchorages are incorporated into the vehicle seat. ABTS is not a common feature in current model year production vehicles or in vehicles produced in the 2003 time frame. ABTS is not a common method for attaching the shoulder belt anchorages for passenger vehicles or minivan vehicles.<sup>28</sup> I am not aware of any 2003 peer vehicles equipped with ABTS in the second row.

While Mr. Hannemann opines that an ABTS system would have provided superior occupant protection in this impact, he does not offer any foundation for this opinion. He provides no testing, data or literature to support an opinion that ABTS would have improved or changed the performance of the subject vehicle's occupant protection systems. More specifically, he presents no data to support a conclusion that H.G.H.'s excursion or kinematics would have been reduced or changed, or that her body would have experienced lower forces, accelerations or deflections. The published studies of the relative effectiveness of ABTS versus conventionally mounted seat belts show that the field performance of the ABTS and conventional seat belts are comparable.<sup>29,30,31</sup>

The reason that ABTS systems have been used in a small number of vehicles is not related to improved occupant protection, but rather is related to difficulties in using conventionally mounted seat belts in some types of vehicles. An ABTS seat does offer some mounting flexibility for the seat belt assembly when a traditional B-pillar is not present. This has been the case with some convertibles, SUVs and extended cab pickup trucks. There have also been applications where it was not practical to directly mount the seat belt assembly to the body of the vehicle. Although a number of vehicles were equipped with ABTS in the early 2000s,

<sup>28</sup> (2008) Padmanaban, J. et al. "Seat Integrated and Conventional Restraints: a Study of Crash Injury/Fatality Rates in Rollovers." AAAM.

<sup>29</sup> Ibid (2008) Padmanaban,

<sup>30</sup> (2008) Warner, M. et al. "Fatal and Severe Injuries in Rear Impact: Seat Stiffness in Recent Field Accident Data." SAE 2008-01-0193.

<sup>31</sup>



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vehicle manufacturers have moved away from this technology; as discussed above, there are currently very few vehicles manufactured with ABTS.

Implementing ABTS is not as straightforward as simply adding a retractor and anchorage points to the seat. ABTS requires that the seat, seat mounts, and floor pan all be significantly strengthened to withstand occupant restraint forces. Stiffening these seats to such a degree may increase the likelihood of injury in frontal collisions for occupants who may be out-of-position in these seats, and for occupants who are sitting behind these seats.<sup>32,33,34,35,36,37</sup> In addition, ABTS designs may be less comfortable and more difficult to use for some occupants than conventional seat belts for a variety of reasons.<sup>38</sup> For example, I am not aware of any ABTS system that incorporates an adjustable D-ring shoulder anchorage; such a feature can help ensure proper and comfortable shoulder belt fit for a variety of occupants. As noted by NHTSA and other researchers, seat belt ease of use and comfort are vitally important to ensure high rates of seat belt use.<sup>39,40,41</sup>

## SUMMARY OF KEY CONCLUSIONS

Based on my background and experience in the areas of mechanical engineering and occupant restraint systems, and the materials reviewed to date, I have formed the above (contained in the body of this report) and following opinions to a reasonable degree of engineering certainty. As additional information becomes available, it may be necessary to continue my investigation and supplement or modify my opinions and conclusions.

1. The 2003 Chrysler Town and Country second-row-right passenger occupant restraint system, including but not limited to the seat and seat belt assembly, is appropriately designed and manufactured.
2. The 2003 Chrysler Town and Country second-row-right passenger occupant restraint system, including but not limited to the seat and seat belt assembly, meets all relevant FMVSSs.

<sup>32</sup> (2008) Viano, D. et al. "Field Accident Data Analysis of 2nd Row Children and Individual Case Reviews." SAE 2008-01-1851.

<sup>33</sup> (2008) Viano, D. et al. "Field Accident Data Analysis of 2nd Row Children and Individual Case Reviews." SAE GIM [presentation].

<sup>34</sup> (2008) Viano, D. et al. "Fatalities of Children 0-7 Years Old in the 2nd Row." Traffic Inj Prev.

<sup>35</sup> (2009) Viano, D. et al. "Influence of Seating Position on Dummy Responses with ABTS Seats in Severe Rear Impacts." SAE 2009-01-0250.

<sup>36</sup> (2009) Viano, D. et al. "Front Seat Performance in Rear Impacts: Effect on 1st and 2nd Row Occupant Injury." SAE 2009-01-0252.

<sup>37</sup> (2013) Viano, D. et al. "Rebound After Rear Impacts." Traffic Inj Prev 14, 181-187.

<sup>38</sup> (2008) Levi, S. et al. "Occupant Protection Issues Among Older Drivers and Passengers: Volume 1 Final Report." NHTSA DOT HS 810 938.

<sup>39</sup> (1981) FRM: Comfort and Convenience Seat Belts. 46 FR 2064.

<sup>40</sup> (2001) Balci, R. et al. "Comfort and Usability of the Seat Belts." SAE 2001-01-0051.

<sup>41</sup> (2003) Chen, L. et al. "Safety Belt Fit, Comfort, and Contact Pressure Based on Upper Anchorage Location and Seat Back Angle." SAE 2003-01-0954.



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3. Occupant protection systems that comply with the FMVSSs have been shown to be highly effective in reducing the risk of injury in motor vehicle collisions.
4. The 2003 Chrysler Town and Country second-row-right passenger seat and seat belt are not defective or unreasonably dangerous.
5. FCA conducted a reasonable amount of testing in the design and development of the 2003 Town and Country second-row-right passenger occupant restraint system, including but not limited to the seat and seat belt assembly, for the subject vehicle.
6. If the seat belt and seat had been used properly, the subject seat belt and seat would have provided good fit for the subject child.
7. If the seat belt and seat had been used properly, the subject seat belt and seat would have provided effective occupant protection and restraint in the subject collision.
8. Because the seat was excessively reclined (in violation of the warnings and instructions), the seat and seat belt were not able to provide the intended restraint and occupant protection.
9. Based on surrogate study, analysis of load marks and consultation with Dr. Courtney regarding occupant kinematics and injuries, H.G.H. did not submarine in the subject crash.
10. H.G.H. was out of position, possibly with her hips slumped forward, according to Dr. Courtney. Her lap belt was not properly positioned low on her pelvis, but was likely resting on her abdomen at the start of the accident. The shoulder belt was not properly positioned against her torso.
11. In any vehicle, if an occupant is out of position with the seat belt improperly positioned, there is an increased risk of injury.
12. The subject 2003 Town and Country performed as designed in the subject crash.
13. If H.G.H. had been properly positioned with the seat belt properly positioned on her pelvis, chest and shoulder, the occupant protection system would have performed well and effectively reduced the risk of serious injury.
14. Mr. Hannemann does not offer any data showing that limiting the seat back recline to an arbitrary angle of 45° would have changed H.G.H.'s restraint effectiveness or outcome.
15. Mr. Hannemann does not offer any data that shows the implementation of ABTS would have changed H.G.H.'s restraint effectiveness or outcome.



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16. No occupant restraint system, including but not limited to the seat and seat belt assembly, can prevent all injuries to all occupants in all motor vehicle accidents.

Sincerely,

A handwritten signature in blue ink, appearing to read "Wm. W. Van Arsdell". The signature is fluid and cursive, with the last name being more prominent.

William W. Van Arsdell, Ph.D., P.E.  
Principal Engineer  
Enclosures





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**Appendix A: Materials Reviewed**

1. Court Documents:
  - a. 2018-02-12 Plf Original Complaint
  - b. 2018-03-26 FCA 1st Amended Answer
  - c. 2018-05-07 FCA Initial Disclosure
  - d. 2018-05-07 Plf Initial Disclosures
  - e. 2018-06-04 Scheduling Order
  - f. 2018-06-08 FCA Resp to Plf 1st RFP (no court doc, files listed below)
  - g. 2018-06-08 FCA US Resp to 1st RFP
  - h. 2018-06-08 FCA US Resp to 2nd RFP
  - i. 2018-07-09 Order Designating Responsible Third Party
  - j. 2018-07-13 Plf Resp to FCA 1st RFP
  - k. 2018-07-13 Plf Resp to FCA 1st Rogs
  - l. 2018-08-13 SIGNED Protective Order
  - m. 2018-09-17 FCA Suppl Resp to Plf 1<sup>st</sup> RFP (as served)
  - n. 2018-09-26 Plf's Designation of Experts
2. First Responder Reports:
  - a. Ponder VFD – Records
  - b. Texas Peace Officer's Crash Report
  - c. Didier\_ 0000-00-00\_ TX DPS - TX Hwy Patrol - Trooper Stockard
  - d. Krum Fire Dept EMS records [also listed in Medical Records]
  - e. 2018-06-08 FCA Resp to Plf 1st RFP
    - i. FCA00041-00042, Texas Peace Officer's Crash Report
    - ii. FCA00043-00047, Ponder VFD records
3. Photographs and Video:
  - a. Didier Crash Photos
  - b. H.G.H. Photos
  - c. 2018-06-08 FCA Resp to Plf 1st RFP
    - i. FCA00001-00002, scene photos
    - ii. FCA00003-00004, scene photos
  - d. 2018-08-30 VI Photos – Amy Courtney
  - e. 2018-09-13 Scene Inspection – Steve Fenton
  - f. 2018-09-13 VI Photos – Steve Fenton
4. Depositions and Exhibits of:
  - a. Didier, Brandi. taken 9/10/18
  - b. H.G.H., taken 9/10/18
5. Expert Reports/Materials of:
  - a. MediSys Rehab – Life Care Plan for H.G.H., 9/26/18
    - i. Harrell, Walter – Testimony List
    - ii. Latorre, Juan – Testimony List



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- iii. Levy, Leigh Anne – Testimony List
    - iv. Lynott, Melissa – CV
    - v. Harrell/Latorre/Levy/Lynott – Fee Schedule & Contract
  - b. Hannemann, Neil – Report, 9/28/18
    - i. Backup Documents – 13.30 Seats, Alternative Designs, Camaro Sled Test Reclined Seats, Reclined Seats Info, Seat Patents
  - c. Ziejewski, Mariusz – Report, 9/28/18
    - i. Inspection Photos – Interior, Exterior, Belt
    - ii. Surrogate Exemplar – Driver Vehicle Interior photos, Surrogate photos, Vehicle Exterior photos, Autostats 2003 Chrysler Town & Country, Autostats 2001 Chrysler Town & Country, FDT, Gebod Haley Hashke [sic], Gebod Surrogate Female, Ht and Wt Comp
    - iii. Medical Diagram – 2
    - iv. Report Graphics
- 6. Production – Subject to Protective Order (FCA):
  - a. 2018-08-13 FCA Resp to Plf 1<sup>st</sup> RFP
    - i. Confidential
      - FMVSS
      - Test List
      - VC11895
      - Lawsuit & Claim Lists
      - Owner Report
    - ii. Not Confidential
      - Owner's Manual
      - VIDR
      - Warranty and Claim Records
      - Advertisements
      - Sales Brochure
  - b. 2018-09-17 FCA Supp Resp to Plf 1<sup>st</sup> RFP
    - i. Confidential
      - Test Lists
    - ii. Not Confidential
      - Operating Manual
      - Ads – Print
      - Ads – TV
- 7. Medical Records from:
  - a. Children's Medical Cntr Med Aff
  - b. Children's Medical Center Billing AFF
  - c. Med City Denton - PW 4596X2442
  - d. Medical City Denton - BR w-Aff
  - e. Medical City of Denton MR
  - f. Medical City of Denton MR AFF



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- g. Questcare ER Bill with AFF
- h. Krum Fire Dept EMS [also listed in First Responder Reports]
- i. Rose Pediatrics
- j. H.G.H., The Clement Firm [Children's Health]
- k. Medical City Denton – Records [ER records]

8. Vehicle Information

- a. 2018-03-07\_ Carfax report for 2003 Chrysler Town & Country VIN 2C8GT64L53R129681

9. Miscellaneous:

- a. Brandi Didier - Colorado Drivers License
- b. Brandi Didier - TX Drivers License
- c. Mom Scan 1
- d. Ferrara Refurbishing [re 2013 Ferrara Fire Truck]
- e. 2018-06-08 FCA Resp to Plf 1st RFP
  - i. FCA00005-00025, fundraising online posts
  - ii. FCA00026-00040, online posts

10. Testing

- a. NHTSA Tests 3561, 3564, 3567, 3573, 3644, 3659, 3783, 3804, 3844, 4146, 4322, 4501, 4647, 4672, 4780, 4932, 4936, 5266, 5542, 5657, 5713, 5760, 5761, 5807, 5842, 5843, 6085, 6087, 6172, 6175, 6262, 6274, 6528

